

Appl. No. 10/088,752
Amdt. dated 9 May 2003
Reply to Office action of 11 Feb 2003

Attorney Doc. No. 57.0357 US PCT

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This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (currently amended) A deposit monitoring apparatus located in a hydrocarbon wellbore comprising:
- an acoustic device adapted to operate in a resonance mode which is longitudinal including a monitoring surface directly exposed to fluids in a hydrocarbon wellbore, wherein the deposition of material on the monitoring surface is monitored by measuring a change in resonance frequency of the acoustic device; and a power supply adapted to supply said monitor with electrical energy.
2. (original) The apparatus of claim 1, wherein the acoustic device is mounted either permanently or quasi-permanently in the wellbore.
3. (cancelled).
4. (currently amended) The apparatus of claim 31, wherein the acoustic device further comprises a transducer, and a focussing element coupled to the transducer.
5. (original) The apparatus of claim 4, wherein the focussing element is an acoustic horn.
6. (original) The apparatus of claim 1, wherein the resonance frequency of the acoustic device is in the range of 10 kHz to 150 kHz.
7. (original) The apparatus of claim 6 wherein the resonance frequency of the acoustic device is in the range of 50 kHz to 100 kHz.
8. (original) The apparatus of claim 1, wherein the monitoring surface is located on or near one of the following devices switches, valves, sleeves, mandrels, downhole separators and sensors located in the wellbore.

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9. (original) The apparatus of claim 1 further comprising a deposit removal system adapted to at least partially remove the deposition from the monitoring surface, the deposit removal system being in a control loop with said deposit monitor.

10. (original) The apparatus of claim 9, wherein the deposit removal system includes a deposition inhibiting or removing chemical agent.

11. (original) The apparatus of claim 9, wherein the deposit removal system uses the acoustic device to exert a physical force onto the deposited material.

12. (original) The apparatus of claim 9, wherein the deposition removal system is near a sensor having a surface exposed to the fluids and the deposition removal system is adapted to remove deposits from said exposed surface.

13. (original) The apparatus of claim 12, wherein the sensor is selected from a group comprising optical sensors, electro-chemical sensors, or acoustic sensors.

14. (currently amended) The apparatus of claim ~~11~~12, wherein the exposed sensor surface is selected from a group comprising optical windows, membranes, or sensitive areas of acoustic sensors.

15. (original) The sensor of claim 1, wherein the sensor includes an additional sensing system to analyze material deposited on the monitoring surface.

16. (currently amended) A ~~deposit~~ monitoring apparatus located in a hydrocarbon wellbore, comprising:

a ~~deposit~~ monitor adapted to measure ~~deposition characteristics of fluids in the hydrocarbon wellbore the monitor having material on a monitoring surface that is~~ directly exposed to fluids in the hydrocarbon wellbore;

~~a power supply adapted to supply said monitor with electrical energy; and~~

a deposit removal system ~~in communication with the deposit monitor~~ including an acoustic device adapted to xert a physical force on the monitoring surface adapted

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to at least partially remove ~~the~~ a deposition of material from the monitoring surface,
~~the deposit removal system being in a control loop with said deposit monitor; and~~
a power supply adapted to supply said deposit removal system with electrical
energy.

17. (original) The apparatus of claim 16, wherein the monitoring surface is located on or near one of the following devices: switches, valves, sleeves, mandrels, downhole separators and sensors located in the wellbore.

18. (currently amended) The apparatus of claim 16 wherein the ~~deposit monitor~~ further comprises an acoustic device adapted to operate in a resonance mode, wherein the ~~deposit monitor~~ measures deposition of the material on the monitoring surface by measuring a change in resonance frequency of the acoustic device of the monitor.

19. (original) The apparatus of claim 18, wherein the acoustic device operates in a longitudinal mode.

20. (original) The apparatus of claim 18, wherein the acoustic device further comprises a transducer, and a focussing element coupled to the transducer.

21. (original) The apparatus of claim 18, wherein the resonance frequency of the acoustic device is in the range of 10 kHz to 150 kHz.

22. (original) The apparatus of claim 18, wherein the deposit removal system includes a deposition inhibiting or removing chemical agent.

23. (cancelled).

24. (cancelled).

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25. (currently amended) The apparatus of claim ~~18~~16, wherein the ~~sensor~~ monitor is selected from a group comprising optical sensors, electro-chemical sensors, or acoustic sensors.

26. (new) The apparatus of claim 16 wherein the monitor is a gamma ray density measurement system.

27. (new) The apparatus of claim 26 wherein the monitoring surface is a nuclear window.

28. (new) The apparatus of claim 16 wherein the monitor is an optical fluid analyzer.

29. (new) The apparatus of claim 28 wherein the monitoring surface includes and optical window.

30. (new) The apparatus of claim 16 wherein the monitor is used to measure activity of an ionic species contained in the wellbore fluid.

31. (new) The apparatus of claim 30 wherein the monitoring surface is a membrane of an ion selective electrode.

32. (new) The apparatus of claim 16 wherein the monitoring surface is a separation membrane.

33. (new) The apparatus of claim 18 wherein the acoustic device of the monitor is the acoustic device of the deposit removal system.

34. (new) A deposit monitoring apparatus located in a hydrocarbon wellbore comprising:

an acoustic device adapted to operate in a resonance mode including a monitoring surface directly exposed to fluids in a hydrocarbon wellbore, wherein the

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deposition of material on the monitoring surface is monitored by measuring a change in resonance frequency of the acoustic device, and wherein by measuring said change in resonance frequency of the acoustic device a thickness of deposited material of 600 microns can be distinguished from a thickness of deposited material of 1050 microns; and

a power supply adapted to supply said monitor with electrical energy.

35. (new) The apparatus of claim 34, wherein the acoustic device is mounted either permanently or quasi-permanently in the wellbore.

36. (new) The apparatus of claim 34, wherein the acoustic device operates in a longitudinal mode.

37. (new) The apparatus of claim 36, wherein the acoustic device further comprises a transducer, and an acoustic horn coupled to the transducer.

38. (new) The apparatus of claim 34, wherein the resonance frequency of the acoustic device is in the range of 10 kHz to 150 kHz.

39. (new) The apparatus of claim 34, wherein the monitoring surface is located on or near one of the following devices switches, valves, sleeves, mandrels, downhole separators and sensors located in the wellbore.

40. (new) The apparatus of claim 34, further comprising a deposit removal system adapted to at least partially remove the deposition from the monitoring surface using the acoustic device to exert a physical force onto the deposited material, the deposit removal system being in a control loop with said deposit monitor.

41. (new) The apparatus of claim 40, wherein the deposition removal system is near a sensor having a surface exposed to the fluids and the deposition removal system is adapted to remove deposits from said exposed surface.
